switch-mode lithium-ion battery charger

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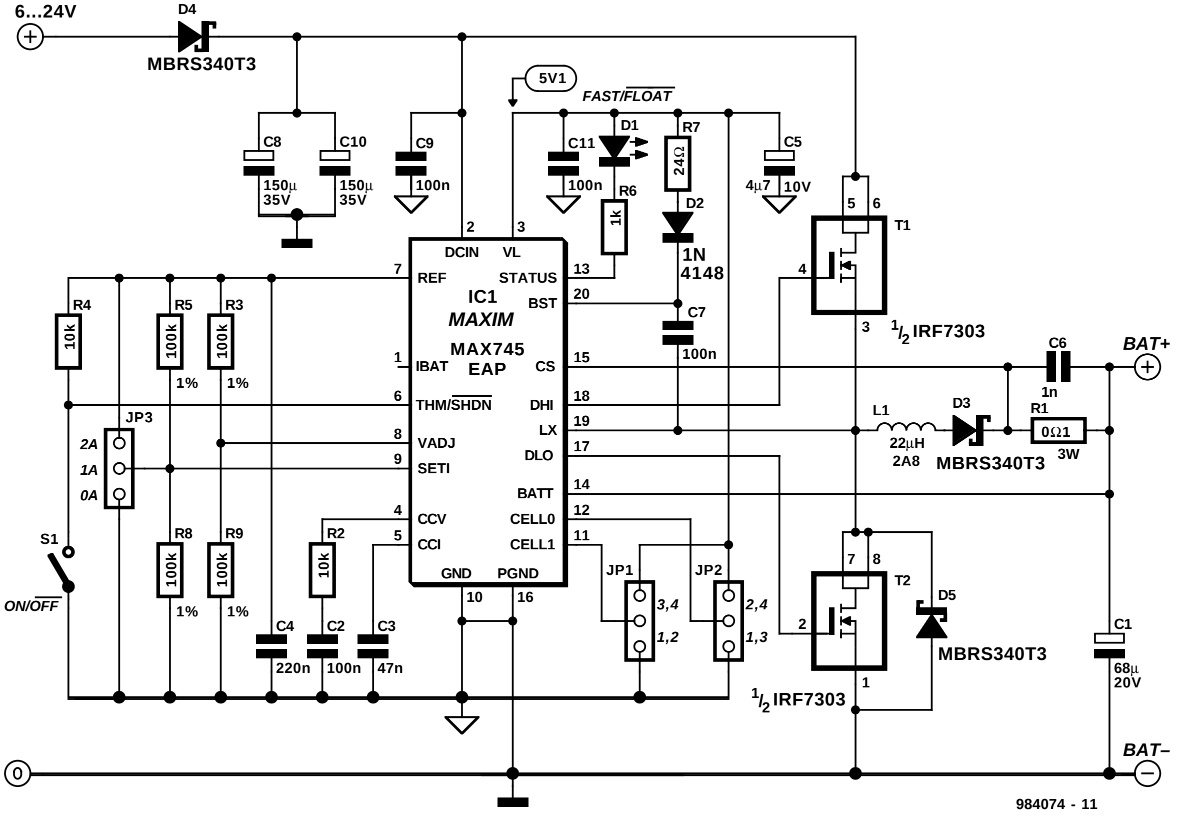
A Maxim application

More and more lithium-ion batteries are being used in all kinds of appliances. These require a battery charger and for this Maxim's MAX745 is ideal. It provides all the functions necessary for charging such batteries or packs of them. It provides a regulated charging current of up to 4 A without getting hot, and a regulated voltage with a total error at the battery terminals of only ±0.75%. It uses low-cost, 1% resistors to set the output voltage, and a low-cost n-channel MOSFET as the power switch.

The MAX745 regulates the voltage set point and charging current using two loops that work together to transition smoothly between voltage and current regulation. The per-cell battery voltage regulation limit is set between 4.0 V and 4.4 V using standard 1% resistors, and then the number of cells is set from 1 to 4 by pin-strapping. The total output voltage error is less than ±0.75%.

The charger is available as an evaluation kit, which is an assembled and tested printed-circuit board that implements a step-down,



switching power supply designed for charging lithium-ion (Li-ion) batteries. The output voltage can be set for one to four cells. The cell voltage can be set between 4.0 V and 4.4 V.

The Li-ion battery pack is connected between BATT and GND (BATT is positive, GND is negative). The battery may be connected with the charger off without causing damage, or it can be connected after power is applied.

The charging voltage is determined by the potential at junction R_3-R_9. Replacing these resistors by a multiturn potentiometer enables the voltage to be set very accurately.

The charging current is selected with jumper JP_3. Here also, a multiturn potentiometer to replace R_5 and R_8 enables a more accurate setting.

The number of cells, and thus the charging voltage, is set with jumpers JP_1 and JP_2: both to ground for one cell, only JP_2 to VL for two cells, only JP_1 to VL for three cells, both to VL for four cells.

Switch S_1 may be replaced by a resistor with negative temperature coefficient (NTC). When the voltage at pin THM drops below 2.1 V, the circuit is switched off automatically; when the voltage reaches 2.3 V again, the circuit is switched on anew.

Transistor T_1 is an n-channel FET whose auxiliary gate voltage is derived from capacitor C_7.

Diode D_1 is a freewheeling diode in case T_1 is cut off. When this happens, the diode is shunted by T_2 (which is on) to improve the efficiency. This is because the drop across the diode is 0.3–0.4 V, whereas that across a conducting transistor is only 0.1 V.

The three Schottky diodes are fast 3 A, 40 V types from Motorola. The FETs may be part of a dual FET from International Rectifier. If discrete ones are used, in view of the switching frequency of 300 kHz, types with a high input capacity must not be used: there is a current of only about 20 mA available for driving the gates. The IRF7303 has parameters: 30 V, 5 A, 0.05 Ω, and 520 pF.

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